INTERNATIONAL STANDARD

ISO 362-1

Third edition
2022-11

Acoustics — Engineering method for measurement of noise emitted by accelerating road vehicles —

Part 1: M and N categories

Acoustique — Méthode d'ingénierie pour le mesurage du bruit émis par les véhicules routiers en accélération —

Partie 1: Catégories M et N

Reference number
ISO 362-1:2022(E)

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Published in Switzerland

Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This third edition cancels and replaces the second edition (ISO 362-1:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clarification on the measurement zone to provide equivalent results between hand held sound level meters and digital data acquisition systems.

— Clarification of original intent of ISO 362-1 on M1/N1 gear ratio selection to account for practical lessons learned.

— Clarification and examples of measures used to control vehicle operation so as to provide the specified accelerations of ISO 362-1

— Addition of and clarification of tolerances, measurement precision, vehicle operation, vehicle physical attributes, and calculation methods where multiple interpretations could be possible.

— Addition of a representative virtual vehicle for N3.

— Update to measurement uncertainty.

A list of all parts in the ISO 362 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

An extensive review was conducted of actual in-use vehicle operations, beginning with data from the TUV Automotive study in the early 1990s and continuing with data developed through other committee members from 1996 through 2000. It includes nearly 100 vehicles operated on a variety of urban roads in Europe and Asia. The primary focus of the in-use measurements was to determine how vehicles are driven with a variety of vehicles, driving behaviours, and traffic situations. The in-use behaviour determined from these studies was successfully correlated to urban traffic use in the United States by evaluation of the fuel economy test cycles used by the United States Environmental Protection Agency (USEPA). The resulting test specifications are therefore valid for all global urban use conditions.

The procedure defined here provides a measure of the sound pressure level from vehicles under controlled and repeatable conditions. The definitions have been made according to the requirements of vehicle categories. In cases of vehicles other than very heavy trucks and buses, the working group found that attempts to conduct a partial load test as in actual use resulted in considerable run-to-run variability that significantly interfered with the repeatability and reproducibility of the test cycle. Therefore, two primary operating conditions (i.e. a wide-open-throttle acceleration phase and a constant speed phase) were used to guarantee simplicity. The combination was found to be equivalent to the partial throttle and partial power (engine load) actually used.

As a further consequence of the investigation of the requirements for an efficient test, it was decided to design a test which was independent of vehicle design and therefore safe and adaptable for future technologies, as well as for future traffic conditions. The test guarantees an excitation of all relevant noise sources, and the final test result reflects a combination of these sources as a compromise between normal urban use and "worst case".

In 2004, the given test for M and N category vehicles was evaluated for technical accuracy and practical considerations by test programmes carried out by the Japan Automobile Standards Internationalization Center (JASIC), the European Automotive Manufacturers Association (ACEA), and the Society of Automotive Engineers, Inc. (SAE) in the United States. Over 180 vehicles were included in these tests. The reports of these test programmes were considered prior to preparation of this document.

This document was developed following demands for a new test procedure considering the following:

— "The test procedure (ISO 362) doesn't reflect realistic driving conditions" (1996 EU Green Paper);

— "In the case of motor vehicles, other factors are also important such as the dominance of tyre noise above quite low speeds (50 km/h)" (1996 EU Green Paper).

— "A new measurement procedure should require that the major noise sources of a vehicle be measured" (2001 Noise Emission of Road Vehicles – I-INCE).

This document, while maintaining the same technical procedures as the previous edition, has been revised based on practical experience to provide additional clarification where multiple interpretations were possible, to provide additional equivalent test modes for heavy commercial vehicles, and to incorporate provisions for addressing and including in the measurement external sound systems for M1 and N1 category vehicles.

Acoustics — Engineering method for measurement of noise emitted by accelerating road vehicles —

Part 1: M and N categories

1 Scope

This document specifies an engineering method for measuring the noise emitted by road vehicles of categories M and N under typical urban traffic conditions. It excludes vehicles of category L1 and L2, which are covered by ISO 9645, and vehicles of category L3, L4, and L5, which are covered by ISO 362-2.

The specifications are intended to reproduce the level of noise generated by the principal noise sources during normal driving in urban traffic (see Annex A).

The method is designed to meet the requirements of simplicity as far as they are consistent with reproducibility of results under the operating conditions of the vehicle.

The test method requires an acoustical environment that is obtained only in an extensive open space. Such conditions are usually provided for

— type approval measurements of a vehicle,

— measurements at the manufacturing stage, and

— measurements at official testing stations.

NOTE 1 The results obtained by this method give an objective measure of the noise emitted under the specified conditions of test. It is necessary to consider the fact that the subjective appraisal of the noise annoyance of different classes of motor vehicles is not simply related to the indications of a sound measurement system. As annoyance is strongly related to personal human perception, physiological human conditions, culture, and environmental conditions, there is a large variation and it is, therefore, not useful as a parameter to describe a specific vehicle condition.

NOTE 2 Spot checks of vehicles chosen at random are rarely made in an ideal acoustical environment. If measurements are carried out on the road in an acoustical environment that does not fulfil the requirements stated in this document, the results obtained can deviate appreciably from the results obtained using the specified conditions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 362-3, *Acoustics – Measurement of noise emitted by accelerating road vehicles – Engineering method, Part 3: Indoor testing M and N categories*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 2416, *Passenger cars — Mass distribution*

ISO 10844, *Acoustics — Specification of test tracks for measuring sound emitted by road vehicles and their tyres*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

IEC 60942, *Electroacoustics — Sound calibrators*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1176 and ISO 2416 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Vehicle mass

3.1.1
kerb mass
complete shipping mass of a vehicle fitted with all standard equipment necessary for normal operation plus the mass of the following elements for M1, N1, and M2 having a maximum authorized mass not exceeding 3 500 kg:

— lubricants, coolant (if needed), washer fluid;

— fuel (tank filled to at least 90 % of the capacity specified by the manufacturer);

— other equipment if included as basic parts for the vehicle, such as spare wheel(s), wheel chocks, fire extinguisher(s), spare parts, and tool kit

Note 1 to entry: The definition of kerb mass can vary from country to country, but in this part of ISO 362, it refers to the definition contained in ISO 1176.

[SOURCE: ISO 1176:1990, 4.4 and 4.6 — modified.]

3.1.2
maximum authorized mass
kerb mass (3.1.1) plus the maximum allowable payload

3.1.3
unladen vehicle mass
nominal mass of a complete N2, N3, or M2 vehicle having a *maximum authorized mass* (3.1.2) greater than 3 500 kg or an M3 vehicle as determined by the following conditions:

a) mass of the vehicle includes the bodywork and all factory-fitted equipment and electrical and auxiliary equipment for normal operation of the vehicle, including liquids, tools, fire extinguisher, standard spare parts, chocks, and spare wheel, if fitted;

b) the fuel tank is filled to at least 90 % of rated capacity and the other liquid-containing systems (except those for used water) are filled to 100 % of the capacity specified by the manufacturer

3.1.4
mass of the driver
nominal mass of a driver

3.1.5
mass in running order
nominal mass of a vehicle as determined by the following conditions:

a) the mass is taken as the sum of the *unladen vehicle mass* (3.1.3) and the driver's mass;

b) in the case of category M2 and M3 vehicles that include seating positions for additional crewmembers, their mass is incorporated in the same way and equal to that of the driver

c) mass in running order mathematically rounded, reported, and used for calculations to a precision of 10 kg (xxxx0)

Note 1 to entry: The driver's mass is calculated in accordance with ISO 2416.

3.1.6
maximum axle (group of axles) capacity
permissible mass corresponding to the maximum mass that can be carried by the axle (group of axles) as defined by the vehicle manufacturer, not exceeding the axle manufacturer's specifications

3.1.7
unladen axle load
actual mass carried by the axle (or group of axles) in an unladen condition, either in the front or the rear of the vehicle

Note 1 to entry: The unladen vehicle mass is equal to the sum of the unladen axles (or group of axles) load.

3.1.8
extra loading
mass which is added to the *unladen vehicle mass* (3.1.3)

3.1.9
laden axle load
actual mass carried by the axle (or group of axles) in a laden condition, either in the front or the rear of the vehicle

3.2
power-to-mass ratio index
PMR
dimensionless quantity used for the calculation of acceleration according to the following formula:

$$\mathrm{PMR} = \frac{P_n}{m_{\mathrm{ro}}} \cdot 1\ 000$$

where

P_{n} is the numerical value of total engine power, expressed in kilowatts;

m_{ro} is the numerical value of the mass in running order, expressed in kilograms;

3.2.1
total engine power
sum of all power from available propulsion sources

3.3
rated engine speed
S
engine speed at which the combustion engine develops its rated maximum net power as stated by the manufacturer

Note 1 to entry: If the rated maximum net power is reached at several engine speeds, *S* used in this document is the highest engine speed at which the rated maximum net power is reached.

Note 2 to entry: ISO 80000-3 defines this term as “rated engine rotational frequency”. The term “rated engine speed” was retained due to its common understanding by practitioners and its use in government regulations.

3.4 Vehicle categories

3.4.1
category L
motor vehicles with fewer than four wheels

Note 1 to entry: United Nations Economic Commission for Europe (UNECE) document TRANS/WP.29/78/Rev.1/Amend.4 (26 April 2005) extended the L category to four-wheeled vehicles as defined by L6 and L7.

3.4.1.1
category L1 and L2
mopeds

Note 1 to entry: See ISO 9645 for further details.

3.4.1.2
category L3
two-wheeled motor vehicles with an engine cylinder capacity greater than 50 cm^3 or maximum speed greater than 50 km/h

3.4.1.3
category L4
three-wheeled motor vehicles with an engine cylinder capacity greater than 50 cm^3 or maximum speed greater than 50 km/h, the wheels being attached asymmetrically along the longitudinal vehicle axis

3.4.1.4
category L5
three-wheeled motor vehicles with an engine cylinder capacity greater than 50 cm^3 or maximum speed greater than 50 km/h, having a gross vehicle mass rating not exceeding 1 000 kg and wheels attached symmetrically along the longitudinal vehicle axis

3.4.1.5
category L6
four-wheeled vehicles whose unladen mass is not more than 350 kg, not including the mass of the batteries in the case of electric vehicles, whose maximum design speed is not more than 45 km/h and whose engine cylinder capacity does not exceed 50 cm^3 for spark (positive) ignition engines, or whose maximum net power output does not exceed 4 kW in the case of other internal combustion engines, or whose maximum continuous rated power does not exceed 4 kW in the case of electric engines

3.4.1.6
category L7
four-wheeled vehicles, other than those classified as *category L6* (3.4.1.5), whose unladen mass is not more than 400 kg or 550 kg for vehicles intended for carrying goods, not including the mass of the batteries in the case of electric vehicles, and whose maximum continuous rated power does not exceed 15 kW

3.4.2
category M
power-driven vehicles having at least four wheels and used for the carriage of passengers

3.4.2.1
category M1
vehicles used for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat

3.4.2.2
category M2
vehicles used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat and having a maximum mass not exceeding 5 000 kg

Note 1 to entry: In this definition, “maximum mass” is equivalent to “maximum authorized mass” used elsewhere in this document.

3.4.2.3
category M3
vehicles used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat and having a maximum mass exceeding 5 000 kg

Note 1 to entry: In this definition, “maximum mass” is equivalent to “maximum authorized mass” used elsewhere in this document.

3.4.2.4
incomplete vehicle of category M2 or M3
incomplete vehicle with just chassis rails or tube assembly, power train, and axles, which is intended to be completed with bodywork, customized to the needs of the transport operator

3.4.3
category N
power-driven vehicles having at least four wheels and used for the carriage of goods

3.4.3.1
category N1
vehicles used for the carriage of goods and having a *maximum authorized mass* (3.1.2) not exceeding 3 500 kg

3.4.3.2
category N2
vehicles used for the carriage of goods and having a *maximum authorized mass* (3.1.2) exceeding 3 500 kg but not exceeding 12 000 kg

3.4.3.3
category N3
vehicles used for the carriage of goods and having a *maximum authorized mass* (3.1.2) exceeding 12 000 kg

3.5
reference point
point depending on the design and category of the vehicle

— for category M1 and N1 vehicles and M2 having a maximum authorized mass not exceeding 3 500 kg point on the vehicle as follows:

  — for front-engine vehicles, the front end of the vehicle;

  — for mid-engine vehicles, the centre of the vehicle;

  — for rear-engine vehicles, the rear end of the vehicle

Note 1 to entry: For vehicles having multiple propulsion sources, the reference point is determined by the position of the propulsion source having the highest power. If there are multiple propulsion sources of equivalent power, then the position of the most forward propulsion source shall prevail.

— for category M2 having a maximum authorized mass exceeding 3 500 kg, M3, N2, and N3 vehicles point on the vehicle as follows:

  — for front-engine vehicles, the front end of the vehicle;

  — for all other vehicles, the border of the engine closest to the front of the vehicle

3.6
target acceleration
acceleration at a partial throttle condition in urban traffic, derived from statistical investigations

Note 1 to entry: Refer to Annex A for more detailed explanations.

3.7
reference acceleration
required acceleration during the acceleration test on the test track

Note 1 to entry: Refer to Annex A for more detailed explanations.

3.8
gear ratio weighting factor
k
dimensionless quantity used to combine the test results of two gear ratios for the acceleration test and the constant-speed test

3.9
partial power factor
k_P
dimensionless quantity used for the weighted combination of the test results of the acceleration test and the constant-speed test for vehicles of categories M1, N1, and M2 having a *maximum authorized mass* (3.1.2) not exceeding 3 500 kg

Note 1 to entry: Refer to Annex A for more detailed explanations.

3.10
pre-acceleration
application of acceleration control device prior to the position AA' for the purpose of achieving stable acceleration between AA' and BB'

Note 1 to entry: See Figure 1 for additional details.

3.11
locked gear ratio
control of transmission such that the transmission gear cannot change during a test

3.12
engine
power source without detachable accessories

Note 1 to entry: power source includes in this context all sources of motive power; for example, electric or hydraulic power sources used alone or in combination with other power sources.

3.13
test track length
l_{10}
length of test track used in the calculation of acceleration from points PP' to BB'

3.14
test track length
l_{20}
length of test track used in the calculation of acceleration from points AA' to BB'

3.15
target engine rotational speed
$n_{\text{target BB'}}$
interval between 70 % and 74 % of the speed *S* for vehicles of category M2 having a *maximum authorized mass* (3.1.2) exceeding 3 500 kg and N2 and an interval between 85 % and 89 % of the speed *S* for vehicles of category M3 and N3

3.16
target vehicle speed
$v_{\text{target BB'}}$
vehicle speed of 35 km/h ± 5 km/h

3.17
kickdown
driver activated automated gearshift to a test condition outside the target conditions

Note 1 to entry: The target conditions are defined in this document.

3.18
prevention of downshift
measure by the vehicle manufacturer to ensure that the vehicle is tested within its specific target conditions

3.19
stable acceleration
acceleration which avoids unsteady accelerations such as lugging, jerking, hesitation, delays, or other similar effects. When acceleration is calculated as part of the measurement, stable acceleration means a consistent acceleration over the complete measurement distance between AA' and BB' plus the vehicle length.

3.20
exterior sound enhancement system
any system installed on the vehicle for producing sound

Note 1 to entry: Exterior sound enhancement systems may be integrated into other components, such as the exhaust, or may be independent units.

4 Symbols, terms and abbreviated terms

Table 1 lists the symbols, terms, and abbreviated terms used in this document and the subclause where they are used for the first time.

Table 1 — Symbols and abbreviated terms used and corresponding clauses

Symbol	Unit	Subclause	Explanation
AA'	—	3.10	Line perpendicular to vehicle travel which indicates beginning of zone in which to record sound pressure level during test
a_i	m/s^2	A.2.6	Partial throttle acceleration in gear ratio *I*; value to be reported and used for calculations to the second decimal place (*x*,*xx*)
a_{max}	m/s^2	A.2.2.3	Maximum acceleration during an acceleration phase measured in in-use studies
$a_{\text{max,90}}$	m/s^2	A.2.3.1	90$^{\text{th}}$ percentile of maximum acceleration during an acceleration phase measured in in-use studies
a_{acc}	m/s^2	A.2.2.1	In-use acceleration measured in urban traffic for a specific vehicle
$a_{\text{acc,50}}$	m/s^2	A.2.8.1	Acceleration at 90$^{\text{th}}$ percentile of noise emission and 50 km/h vehicle velocity for a specific vehicle
$a_{\text{acc},i}$	m/s^2	5.1	Acceleration in gear ratio *I*; value to be reported and used for calculations to the second decimal place (*x*,*xx*)

Table 1 *(continued)*

Symbol	Unit	Subclause	Explanation
$a_{acc\ (i+1)}$	m/s^2	5.1	Acceleration in gear ratio (i + 1); value to be reported and used for calculations to the second decimal place (x,xx)
$a_{acc,test}$	m/s^2	5.1	Acceleration in single gear ratio test cases; value to be reported and used for calculations to the second decimal place (x,xx)
$a_{acc,ref}$	m/s^2	5.4	Reference acceleration for the acceleration test; value to be reported and used for calculations to the second decimal place (x,xx)
a_{urban}	m/s^2	5.3	Target acceleration representing urban traffic acceleration; value to be reported and used for calculations to the second decimal place (x,xx)
BB'	—	3.10	Line perpendicular to vehicle travel which indicates end of zone in which is 10,00 m behind line PP'
CC'	—	8.1	Centre line of vehicle travel through test surface as defined in ISO 10844
$\delta_1 - \delta_7$	dB	B.2	Input quantities to allow for any uncertainty
gear ratio i	—	8.3.1.3.2	Gear ratio which provides an acceleration within the 5 percent tolerance of the reference acceleration $a_{acc,ref}$ or greater than the reference acceleration $a_{acc,ref}$
gear ratio (i + 1)	—	8.3.1.3.2	The second of two gear ratios, with an acceleration lower than gear ratio i
gear ratio i+2, i+3, …		8.3.1.3.2	Gear ratios selectable, if gear ratio i and gear ratio i + 1 exceed an acceleration of 2,0 m/s^2
gear x	—	8.3.2.3.2	First of two gear ratios used for testing of M2 having a maximum authorized mass of more than 3 500 kg, M3, N2, and N3 where certain criteria on test conditions are met
gear y	—	8.3.2.3.2	Second of two gear ratios used for testing of M2 having a maximum authorized mass of more than 3 500 kg, M3, N2, and N3 where certain criteria on test conditions are met
j	—	5.2.1	Index for single test run within overall acceleration or constant speed test series i or (i + 1)
k_P	—	3.9	Partial power factor; value to be reported and used for calculations to the second decimal place (x,xx)
k	—	3.8	Gear ratio weighting factor; value to be reported and used for calculations to the second decimal place
k_n	—	A.2.8.1	Interpolation factor between gears
l_{ref}	m	5.1	Reference length
l_{veh}	m	5.1	Length of vehicle; value to be reported and used for calculations to a precision of 0,01 m (1 cm)
l_{10}	m	3.13	Length of test section for calculation of acceleration from PP' to BB'
l_{20}	m	3.14	Length of test section for calculation of acceleration from AA' to BB'
$L_{crs,i}$	dB	8.4.3.2	Vehicle sound pressure level at constant speed test for gear i; value to be reported and used for calculations to the first decimal place (xx,x)
$L_{crs\ (i+1)}$	dB	8.4.3.2	Vehicle sound pressure level at constant speed test for gear (i + 1); value to be reported and used for calculations to the first decimal place (xx,x)
$L_{crs,rep}$	dB	8.4.3.2	Reported vehicle sound pressure level at constant speed test; value to be reported and used for calculations to the first decimal place (xx,x)
$L_{acc,i}$	dB	8.4.3.2	Vehicle sound pressure level at acceleration test for gear i; value to be reported and used for calculations to the first decimal place (xx,x)

Table 1 *(continued)*

Symbol	Unit	Subclause	Explanation
$L_{acc\ (i+1)}$	dB	8.4.3.2	Vehicle sound pressure level at acceleration test for gear (i + 1); value to be reported and used for calculations to the first decimal place (xx,x)
$L_{acc,rep}$	dB	8.4.3.2	Reported vehicle sound pressure level at acceleration; value to be reported and used for calculations to the first decimal place (xx,x)
L_{urban}	dB	8.4.3.2	Reported vehicle sound pressure level representing urban operation; value to be reported mathematically rounded to the nearest integer (xx)
$m_{ac,ra,max}$	kg	8.2.2.1	Maximum rear axle capacity
$m_{ac,ra,max\ (chosen)}$	kg	8.2.2.2.4	Technically permissible maximum laden mass allowed for the chosen rear axle (as defined in 8.2.2.2.4)
$m_{chassisM2M3}$	kg	8.2.2.1	Mass of the incomplete vehicle (M2 or M3)
m_d	kg	8.2.2.1	Mass of the driver
$m_{fa,load,laden}$	kg	8.2.2.2.2	Laden front axle load
$m_{fa,load,unladen}$	kg	8.2.2.1	Unladen front axle load
$m_{fa,(vrf),load,unladen}$	kg	8.2.2.2.4	Measured unladen front axle load of the virtual vehicle with more than two axles
$m_{ra,load,laden}$	kg	8.2.2.2.2	Laden rear axle load
$m_{ra,load,unladen}$	kg	8.2.2.1	Unladen rear axle load
m_{ro}	kg	8.2.2.1	Mass in running order
M_t	kg	3.2	Test mass of the vehicle
$m_{t\ (2\ axles\ virtual)}$	kg	8.2.2.2.4	Test mass of a virtual vehicle with two axles (4×2 or 4×4)
m_{target}	kg	8.2.2.1	Target mass of the vehicle
$m_{unladen}$	kg	8.2.2.1	Unladen vehicle mass
$m_{unladen\ (2\ axles\ virtual)}$	kg	8.2.2.2.4	Unladen vehicle mass of the virtual vehicle with two axles
m_{xload}	kg	8.2.2.1	Extra loading
$m_{xload\ (2\ axles\ virtual)}$	kg	8.2.2.2.4	Extra loading for the virtual vehicle with two axles
$m_{xloadM2M3}$	kg	8.2.2.1	Extra load to be added to the incomplete vehicle (M2 or M3) to reach the mass of the vehicle in running order as chosen by the manufacturer
n	—	8.3.1.3.2	Gear index number (see Note 3)
n	1/min	A.2.4	Engine rotational speed of the vehicle
$n_{PP'}$	1/min	9	Engine rotational speed of the vehicle when the reference point passes PP'; value to be reported and used for calculations to a precision of 10 min^{-1} ($xxx0$)
$n_{BB'}$	1/min	8.3.2.1	Engine rotational speed of the vehicle when the reference point passes BB'; value to be reported and used for calculations to a precision of 10 min^{-1} ($xxx0$)
$n_{BB'i}$, i=1,2	1/min	8.3.2.3.3	engine rotational speed when the reference point passes BB' when certain conditions are met
$n_{max'}$	1/min	8.3.1.3.2	Maximum engine rotational speed permitted for M1, N1, and M2 less than 3 500 kg; value to be reported and used for calculations to a precision of 10 min^{-1} ($xxx0$)
$n_{target\ BB'}$	1/min	8.3.2.2	Target engine rotational speed of the vehicle when the reference point has to pass line BB' (see 5.1 for definition of reference point)